



IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management

IPv6 zone-based firewalls support the Protection of Distributed Denial of Service Attacks and the Firewall Resource Management features.

The Protection Against Distributed Denial of Service Attacks feature provides protection from Denial of Service (DoS) attacks at the global level (for all firewall sessions) and at the VPN routing and forwarding (VRF) level. With the Protection Against Distributed Denial of Service Attacks feature, you can configure the aggressive aging of firewall sessions, event rate monitoring of firewall sessions, half-opened connections limit, and global TCP synchronization (SYN) cookie protection to prevent distributed DoS attacks.

The Firewall Resource Management feature limits the number of VPN Routing and Forwarding (VRF) and global firewall sessions that are configured on a device.

This module describes how to configure the Protection of Distributed Denial of Service Attacks and the Firewall Resource Management features.

- [Restrictions for IPv6 Firewall Support for Protection Against Distributed Denial of Service Attacks and Resource Management, on page 2](#)
- [Information About IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management, on page 2](#)
- [How to Configure IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management, on page 6](#)
- [Configuration Examples for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management, on page 29](#)
- [Additional References for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management, on page 32](#)
- [Feature Information for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management, on page 33](#)

Restrictions for IPv6 Firewall Support for Protection Against Distributed Denial of Service Attacks and Resource Management

The following restriction applies to the Firewall Resource Management feature:

- After you configure the global-level or the virtual routing and forwarding (VRF)-level session limit and reconfigure the session limit, if the global-level or the VRF-level session limit is below the initially configured session count, no new session is added; however, no current session is dropped.

Information About IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management

Aggressive Aging of Firewall Sessions

The Aggressive Aging feature provides the firewall the capability of aggressively aging out sessions to make room for new sessions, thereby protecting the firewall session database from filling. The firewall protects its resources by removing idle sessions. The Aggressive Aging feature allows firewall sessions to exist for a shorter period of time defined by a timer called aging-out time.

The Aggressive Aging feature includes thresholds to define the start and end of the aggressive aging period—high and low watermarks. The aggressive aging period starts when the session table crosses the high watermark and ends when it falls below the low watermark. During the aggressive aging period, sessions will exist for a shorter period of time that you have configured by using the aging-out time. If an attacker initiates sessions at a rate that is faster than the rate at which the firewall terminates sessions, all resources that are allocated for creating sessions are used and all new connections are rejected. To prevent such attacks, you can configure the Aggressive Aging feature to aggressively age out sessions. This feature is disabled by default.

You can configure aggressive aging for half-opened sessions and total sessions at the box level (box refers to the entire firewall session table) and the virtual routing and forwarding (VRF) level. If you have configured this feature for total sessions, all sessions that consume firewall session resources are taken into account. Total sessions comprise established sessions, half-opened sessions, and sessions in the imprecise session database. (A TCP session that has not yet reached the established state is called a half-opened session.)

A firewall has two session databases: the session database and the imprecise session database. The session database contains sessions with 5-tuple (the source IP address, the destination IP address, the source port, the destination port, and the protocol). A tuple is an ordered list of elements. The imprecise session database contains sessions with fewer than 5-tuple (missing IP addresses, port numbers, and so on). In the case of aggressive aging for half-opened sessions, only half-opened sessions are considered.

You can configure an aggressive aging-out time for Internet Control Message Protocol (ICMP), TCP, and UDP firewall sessions. The aging-out time is set by default to the idle time.

Event Rate Monitoring Feature

The Event Rate Monitoring feature monitors the rate of predefined events in a zone. The Event Rate Monitoring feature includes basic threat detection, which is the ability of a security device to detect possible threats, anomalies, and attacks to resources inside the firewall and to take action against them. You can configure a basic threat detection rate for events. When the incoming rate of a certain type of event exceeds the configured threat detection rate, event rate monitoring considers this event as a threat and takes action to stop the threat. Threat detection inspects events only on the ingress zone (if the Event Rate Monitoring feature is enabled on the ingress zone).

The network administrator is informed about the potential threats via an alert message (syslog or high-speed logger [HSL]) and can take actions such as detecting the attack vector, detecting the zone from which the attack is coming, or configuring devices in the network to block certain behaviors or traffic.

The Event Rate Monitoring feature monitors the following types of events:

- Firewall drops due to basic firewall checks failure—This can include zone or zone-pair check failures, or firewall policies configured with the drop action, and so on.
- Firewall drops due to Layer 4 inspection failure—This can include TCP inspections that have failed because the first TCP packet is not a synchronization (SYN) packet.
- TCP SYN cookie attack—This can include counting the number of SYN packets that are dropped and the number of SYN cookies that are sent as a spoofing attack.

The Event Rate Monitoring feature monitors the average rate and the burst rate of different events. Each event type has a rate object that is controlled by an associated rate that has a configurable parameter set (the average threshold, the burst threshold, and a time period). The time period is divided into time slots; each time slot is 1/30th of the time period.

The average rate is calculated for every event type. Each rate object holds 30 completed sampling values plus one value to hold the current ongoing sampling period. The current sampling value replaces the oldest calculated value and the average is recalculated. The average rate is calculated during every time period. If the average rate exceeds the average threshold, the Event Rate Monitoring feature will consider this as a possible threat, update the statistics, and inform the network administrator.

The burst rate is implemented by using the token bucket algorithm. For each time slot, the token bucket is filled with tokens. For each event that occurs (of a specific event type), a token is removed from the bucket. An empty bucket means that the burst threshold is reached, and the administrator receives an alarm through the syslog or HSL. You can view the threat detection statistics and learn about possible threats to various events in the zone from the output of the **show policy-firewall stats zone** command.

You must first enable basic threat detection by using the **threat-detection basic-threat** command. Once basic threat detection is configured, you can configure the threat detection rate. To configure the threat detection rate, use the **threat-detection rate** command.

The following table describes the basic threat detection default settings that are applicable if the Event Rate Monitoring feature is enabled.

Table 1: Basic Threat Detection Default Settings

Packet Drop Reason	Threat Detection Settings
Basic firewall drops	average-rate 400 packets per second (pps) burst-rate 1600 pps rate-interval 600 seconds
Inspection-based firewall drops	average-rate 400 pps burst-rate 1600 pps rate-interval 600 seconds
SYN attack firewall drops	average-rate 100 pps burst-rate 200 pps rate-interval 600 seconds

Half-Opened Connections Limit

The firewall session table supports the limiting of half-opened firewall connections. Limiting the number of half-opened sessions will defend the firewall against attacks that might fill the firewall session table at the per-box level or at the virtual routing and forwarding (VRF) level with half-opened sessions and prevent sessions from being established. The half-opened connection limit can be configured for Layer 4 protocols, Internet Control Message Protocol (ICMP), TCP, and UDP. The limit set to the number of UDP half-opened sessions will not affect the TCP or ICMP half-opened sessions. When the configured half-opened session limit is exceeded, all new sessions are rejected and a log message is generated, either in syslog or in the high-speed logger (HSL).

The following sessions are considered as half-opened sessions:

- TCP sessions that have not completed the three-way handshake.
- UDP sessions that have only one packet detected in the UDP flow.
- ICMP sessions that do not receive a reply to the ICMP echo request or the ICMP time-stamp request.

TCP SYN-Flood Attacks

You can configure the global TCP SYN-flood limit to limit SYN flood attacks. TCP SYN-flooding attacks are a type of denial of service (DoS) attack. When the configured TCP SYN-flood limit is reached, the firewall verifies the source of sessions before creating more sessions. Usually, TCP SYN packets are sent to a targeted end host or a range of subnet addresses behind the firewall. These TCP SYN packets have spoofed source IP addresses. A spoofing attack is when a person or program tries to use false data to gain access to resources in a network. TCP SYN flooding can take up all resources on a firewall or an end host, thereby causing denial of service to legitimate traffic. You can configure TCP SYN-flood protection at the VRF level and the zone level.

SYN flood attacks are divided into two types:

- Host flood—SYN flood packets are sent to a single host intending to utilize all resources on that host.

- Firewall session table flood—SYN flood packets are sent to a range of addresses behind the firewall, with the intention of exhausting the session table resources on the firewall, thereby denying resources to the legitimate traffic going through the firewall.

Firewall Resource Management

Resource Management limits the level of usage of shared resources on a device. Shared resources on a device include:

- Bandwidth
- Connection states
- Memory usage (per table)
- Number of sessions or calls
- Packets per second
- Ternary content addressable memory (TCAM) entries

The Firewall Resource Management feature extends the zone-based firewall resource management from the class level to the VRF level and the global level. Class-level resource management provides resource protection for firewall sessions at a class level. For example, parameters such as the maximum session limit, the session rate limit, and the incomplete session limit protect firewall resources (for example, chunk memory) and keep these resources from being used up by a single class.

When virtual routing and forwarding (VRF) instances share the same policy, a firewall session setup request from one VRF instance can make the total session count reach the maximum limit. When one VRF consumes the maximum amount of resources on a device, it becomes difficult for other VRF instances to share device resources. To limit the number of VRF firewall sessions, you can use the Firewall Resource Management feature.

At the global level, the Firewall Resource Management feature helps limit the usage of resources at the global routing domain by firewall sessions.

Firewall Sessions

Session Definition

At the virtual routing and forwarding (VRF) level, the Firewall Resource Management feature tracks the firewall session count for each VRF instance. At the global level, the firewall resource management tracks the total firewall session count at the global routing domain and not at the device level. In both the VRF and global levels, session count is the sum of opened sessions, half-opened sessions, and sessions in the imprecise firewall session database. A TCP session that has not yet reached the established state is called a half-opened session.

A firewall has two session databases: the session database and the imprecise session database. The session database contains sessions with 5-tuple (source IP address, destination IP address, source port, destination port, and protocol). A tuple is an ordered list of elements. The imprecise session database contains sessions with fewer than 5-tuple (missing IP addresses, port numbers, and so on).

The following rules apply to the configuration of a session limit:

- The class-level session limit can exceed the global limit.
- The class-level session limit can exceed its associated VRF session maximum.
- The sum of the VRF limit, including the global context, can be greater than the hardcoded session limit.

Session Rate

The session rate is the rate at which sessions are established at any given time interval. You can define maximum and minimum session rate limits. When the session rate exceeds the maximum specified rate, the firewall starts rejecting new session setup requests.

From the resource management perspective, setting the maximum and minimum session rate limit helps protect Cisco Packet Processor from being overwhelmed when numerous firewall session setup requests are received.

Incomplete or Half-Opened Sessions

Incomplete sessions are half-opened sessions. Any resource used by an incomplete session is counted, and any growth in the number of incomplete sessions is limited by setting the maximum session limit.

Firewall Resource Management Sessions

The following rules apply to firewall resource management sessions:

- By default, the session limit for opened and half-opened sessions is unlimited.
- Opened or half-opened sessions are limited by parameters and counted separately.
- Opened or half-opened session count includes Internet Control Message Protocol (ICMP), TCP, or UDP sessions.
- You can limit the number and rate of opened sessions.
- You can only limit the number of half-opened sessions.

How to Configure IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management

Configuring an IPv6 Firewall

The steps to configure an IPv4 firewall and an IPv6 firewall are the same. To configure an IPv6 firewall, you must configure the class map in such a way that only an IPv6 address family is matched.

The **match protocol** command applies to both IPv4 and IPv6 traffic and can be included in either an IPv4 policy or an IPv6 policy.

SUMMARY STEPS

1. `enable`

2. **configure terminal**
3. **vrf-definition** *vrf-name*
4. **address-family ipv6**
5. **exit-address-family**
6. **exit**
7. **parameter-map type inspect** *parameter-map-name*
8. **sessions maximum** *sessions*
9. **exit**
10. **ipv6 unicast-routing**
11. **ip port-map** *appl-name* **port** *port-num* **list** *list-name*
12. **ipv6 access-list** *access-list-name*
13. **permit ipv6 any any**
14. **exit**
15. **class-map type inspect match-all** *class-map-name*
16. **match access-group name** *access-group-name*
17. **match protocol** *protocol-name*
18. **exit**
19. **policy-map type inspect** *policy-map-name*
20. **class type inspect** *class-map-name*
21. **inspect** [*parameter-map-name*]
22. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enters privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	vrf-definition <i>vrf-name</i> Example: Device(config)# vrf-definition VRF1	Configures a virtual routing and forwarding (VRF) routing table instance and enters VRF configuration mode.
Step 4	address-family ipv6 Example: Device(config-vrf)# address-family ipv6	Enters VRF address family configuration mode and configures sessions that carry standard IPv6 address prefixes.
Step 5	exit-address-family Example: Device(config-vrf-af)# exit-address-family	Exits VRF address family configuration mode and enters VRF configuration mode.

	Command or Action	Purpose
Step 6	exit Example: Device(config-vrf)# exit	Exits VRF configuration mode and enters global configuration mode.
Step 7	parameter-map type inspect <i>parameter-map-name</i> Example: Device(config)# parameter-map type inspect ipv6-param-map	Enables a global inspect-type parameter map for the firewall to connect thresholds, timeouts, and other parameters that pertain to the inspect action, and enters parameter-map type inspect configuration mode.
Step 8	sessions maximum <i>sessions</i> Example: Device(config-profile)# sessions maximum 10000	Sets the maximum number of allowed sessions that can exist on a zone pair.
Step 9	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 10	ipv6 unicast-routing Example: Device(config)# ipv6 unicast-routing	Enables the forwarding of IPv6 unicast datagrams.
Step 11	ip port-map <i>appl-name</i> port <i>port-num</i> list <i>list-name</i> Example: Device(config)# ip port-map ftp port 8090 list ipv6-acl	Establishes a port to application mapping (PAM) by using the IPv6 access control list (ACL).
Step 12	ipv6 access-list <i>access-list-name</i> Example: Device(config)# ipv6 access-list ipv6-acl	Defines an IPv6 access list and enters IPv6 access list configuration mode.
Step 13	permit ipv6 any any Example: Device(config-ipv6-acl)# permit ipv6 any any	Sets permit conditions for an IPv6 access list.
Step 14	exit Example: Device(config-ipv6-acl)# exit	Exits IPv6 access list configuration mode and enters global configuration mode.
Step 15	class-map type inspect match-all <i>class-map-name</i> Example: Device(config)# class-map type inspect match-all ipv6-class	Creates an application-specific inspect type class map and enters QoS class-map configuration mode.
Step 16	match access-group name <i>access-group-name</i> Example:	Configures the match criteria for a class map on the basis of the specified ACL.

	Command or Action	Purpose
	Device(config-cmap)# match access-group name ipv6-acl	
Step 17	match protocol <i>protocol-name</i> Example: Device(config-cmap)# match protocol tcp	Configures a match criterion for a class map on the basis of the specified protocol.
Step 18	exit Example: Device(config-cmap)# exit	Exits QoS class-map configuration mode and enters global configuration mode.
Step 19	policy-map type inspect <i>policy-map-name</i> Example: Device(config)# policy-map type inspect ipv6-policy	Creates a protocol-specific inspect type policy map and enters QoS policy-map configuration mode.
Step 20	class type inspect <i>class-map-name</i> Example: Device(config-pmap)# class type inspect ipv6-class	Specifies the traffic class on which an action is to be performed and enters QoS policy-map class configuration mode.
Step 21	inspect [<i>parameter-map-name</i>] Example: Device(config-pmap-c)# inspect ipv6-param-map	Enables stateful packet inspection.
Step 22	end Example: Device(config-pmap-c)# end	Exits QoS policy-map class configuration mode and enters privileged EXEC mode.

Configuring the Aggressive Aging of Firewall Sessions

You can configure the Aggressive Aging feature for per-box (per-box refers to the entire firewall session table), default-VRF, and per-VRF firewall sessions. Before the Aggressive Aging feature can work, you must configure the aggressive aging and the aging-out time of firewall sessions.

Perform the following tasks to configure the aggressive aging of firewall sessions.

Configuring per-Box Aggressive Aging

Per-box refers to the entire firewall session table. Any configuration that follows the **parameter-map type inspect-global** command applies to the box.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Enter one of the following commands:
 - **parameter-map type inspect-global**

- **parameter-map type inspect global**

4. **per-box max-incomplete** *number* **aggressive-aging high** {*value low value* | **percent percent low percent percent**}
5. **per-box aggressive-aging high** {*value low value* | **percent percent low percent percent**}
6. **exit**
7. **parameter-map type inspect** *parameter-map-name*
8. **tcp synwait-time** *seconds* [**ageout-time** *seconds*]
9. **end**
10. **show policy-firewall stats global**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	Enter one of the following commands: <ul style="list-style-type: none"> • parameter-map type inspect-global • parameter-map type inspect global Example: Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspect global	Configures a global parameter map for connecting thresholds and timeouts and enters parameter-map type inspect configuration mode. <ul style="list-style-type: none"> • Based on your release, the parameter-map type inspect-global and the parameter-map type inspect global commands are supported. You cannot configure both these commands together. • Skip Steps 4 and 5 if you configure the parameter-map type inspect-global command. Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.
Step 4	per-box max-incomplete <i>number</i> aggressive-aging high { <i>value low value</i> percent percent low percent percent }	Configures the maximum limit and the aggressive aging rate for half-opened sessions in the firewall session table.
	Example: Device(config-profile)# per-box max-incomplete 2000 aggressive-aging high 1500 low 1200	
Step 5	per-box aggressive-aging high { <i>value low value</i> percent percent low percent percent }	Configures the aggressive aging limit of total sessions.

	Command or Action	Purpose
	Example: Device(config-profile)# per-box aggressive-aging high 1700 low 1300	
Step 6	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 7	parameter-map type inspect <i>parameter-map-name</i> Example: Device(config)# parameter-map type inspect pmap1	Configures an inspect-type parameter map for connecting thresholds, timeouts, and other parameters pertaining to the inspect action and enters parameter-map type inspect configuration mode.
Step 8	tcp synwait-time <i>seconds</i> [<i>ageout-time seconds</i>] Example: Device(config-profile)# tcp synwait-time 30 ageout-time 10	Specifies how long the software will wait for a TCP session to reach the established state before dropping the session. <ul style="list-style-type: none"> After aggressive aging is enabled, the SYN wait timer of the oldest TCP connections are reset from the default to the configured ageout time. In this example, instead of waiting for 30 seconds for connections to timeout, the timeout of the oldest TCP connections are set to 10 seconds. Aggressive aging is disabled when the connections drop below the low watermark.
Step 9	end Example: Device(config-profile)# end	Exits parameter-map type inspect configuration mode and enters privileged EXEC mode.
Step 10	show policy-firewall stats global Example: Device# show policy-firewall stats global	Displays global firewall statistics information.

Configuring Aggressive Aging for a Default VRF

When you configure the **max-incomplete aggressive-aging** command, it applies to the default VRF.

SUMMARY STEPS

- enable**
- configure terminal**
- Enters one of the following commands:
 - parameter-map type inspect-global**
 - parameter-map type inspect global**
- max-incomplete *number* aggressive-aging high {*value low value* | **percent percent low percent percent**}**

5. `session total number [aggressive-aging high {value low value | percent percent low percent percent}]`
6. `exit`
7. `parameter-map type inspect parameter-map-name`
8. `tcp synwait-time seconds [ageout-time seconds]`
9. `end`
10. `show policy-firewall stats vrf global`

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	Enters one of the following commands: <ul style="list-style-type: none"> • parameter-map type inspect-global • parameter-map type inspect global Example: Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspect global	Configures a global parameter map for connecting thresholds and timeouts and enters parameter-map type inspect configuration mode. <ul style="list-style-type: none"> • Based on your release, the parameter-map type inspect-global and the parameter-map type inspect global commands are supported. You cannot configure both these commands together. • Skip Step 5 if you configure the parameter-map type inspect-global command. Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.
Step 4	max-incomplete number aggressive-aging high {value low value percent percent low percent percent} Example: Device(config-profile)# max-incomplete 3455 aggressive-aging high 2345 low 2255	Configures the maximum limit and the aggressive aging limit of half-opened firewall sessions.
Step 5	session total number [aggressive-aging high {value low value percent percent low percent percent}] Example: Device(config-profile)# session total 1000 aggressive-aging high percent 80 low percent 60	Configures the total limit and the aggressive aging limit for total firewall sessions.

	Command or Action	Purpose
Step 6	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 7	parameter-map type inspect <i>parameter-map-name</i> Example: Device(config)# parameter-map type inspect pmap1	Configures an inspect-type parameter map for connecting thresholds, timeouts, and other parameters pertaining to the inspect action and enters parameter-map type inspect configuration mode.
Step 8	tcp synwait-time <i>seconds</i> [<i>ageout-time seconds</i>] Example: Device(config-profile)# tcp synwait-time 30 ageout-time 10	Specifies how long the software will wait for a TCP session to reach the established state before dropping the session. <ul style="list-style-type: none"> After aggressive aging is enabled, the SYN wait timer of the oldest TCP connections are reset from the default to the configured ageout time. In this example, instead of waiting for 30 seconds for connections to timeout, the timeout of the oldest TCP connections are set to 10 seconds. Aggressive aging is disabled when the connections drop below the low watermark.
Step 9	end Example: Device(config-profile)# end	Exits parameter-map type inspect configuration mode and enters privileged EXEC mode.
Step 10	show policy-firewall stats vrf global Example: Device# show policy-firewall stats vrf global	Displays global VRF firewall policy statistics.

Configuring per-VRF Aggressive Aging

SUMMARY STEPS

- enable**
- configure terminal**
- ip vrf *vrf-name***
- rd *route-distinguisher***
- route-target export *route-target-ext-community***
- route-target import *route-target-ext-community***
- exit**
- parameter-map type inspect-vrf *vrf-pmap-name***
- max-incomplete *number* aggressive-aging high {*value low value* | percent *percent low percent percent*}**
- session total *number* [aggressive-aging {*high value low value* | percent *percent low percent percent*}]**
- alert on**
- exit**

13. Enter one of the following commands:
 - **parameter-map type inspect-global**
 - **parameter-map type inspect global**
14. **vrf** *vrf-name* **inspect** *vrf-pmap-name*
15. **exit**
16. **parameter-map type inspect** *parameter-map-name*
17. **tcp idle-time** *seconds* [**ageout-time** *seconds*]
18. **tcp synwait-time** *seconds* [**ageout-time** *seconds*]
19. **exit**
20. **policy-map type inspect** *policy-map-name*
21. **class type inspect match-any** *class-map-name*
22. **inspect** *parameter-map-name*
23. **end**
24. **show policy-firewall stats vrf** *vrf-pmap-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip vrf <i>vrf-name</i> Example: Device(config)# ip vrf ddos-vrf1	Defines a VRF instance and enters VRF configuration mode.
Step 4	rd <i>route-distinguisher</i> Example: Device(config-vrf)# rd 100:2	Specifies a route distinguisher (RD) for a VRF instance.
Step 5	route-target export <i>route-target-ext-community</i> Example: Device(config-vrf)# route-target export 100:2	Creates a route-target extended community and exports the routing information to the target VPN extended community.
Step 6	route-target import <i>route-target-ext-community</i> Example: Device(config-vrf)# route-target import 100:2	Creates a route-target extended community and imports routing information from the target VPN extended community.
Step 7	exit Example: Device(config-vrf)# exit	Exits VRF configuration mode and enters global configuration mode.

	Command or Action	Purpose
Step 8	<p>parameter-map type inspect-vrf <i>vrf-pmap-name</i></p> <p>Example:</p> <pre>Device(config)# parameter-map type inspect-vrf vrf1-pmap</pre>	Configures an inspect VRF-type parameter map and enters parameter-map type inspect configuration mode.
Step 9	<p>max-incomplete <i>number</i> aggressive-aging high {<i>value</i> low <i>value</i> percent <i>percent</i> low percent <i>percent</i>}</p> <p>Example:</p> <pre>Device(config-profile)# max-incomplete 2000 aggressive-aging high 1500 low 1200</pre>	Configures the maximum limit and the aggressive aging limit for half-opened sessions.
Step 10	<p>session total <i>number</i> [aggressive-aging {high <i>value</i> low <i>value</i> percent <i>percent</i> low percent <i>percent</i>}]</p> <p>Example:</p> <pre>Device(config-profile)# session total 1000 aggressive-aging high percent 80 low percent 60</pre>	<p>Configures the total session limit and the aggressive aging limit for the total sessions.</p> <ul style="list-style-type: none"> You can configure the total session limit as an absolute value or as a percentage.
Step 11	<p>alert on</p> <p>Example:</p> <pre>Device(config-profile)# alert on</pre>	Enables the console display of stateful packet inspection alert messages.
Step 12	<p>exit</p> <p>Example:</p> <pre>Device(config-profile)# exit</pre>	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 13	<p>Enter one of the following commands:</p> <ul style="list-style-type: none"> parameter-map type inspect-global parameter-map type inspect global <p>Example:</p> <pre>Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspect global</pre>	<p>Configures a global parameter map and enters parameter-map type inspect configuration mode.</p> <ul style="list-style-type: none"> Based on your release, the parameter-map type inspect-global and the parameter-map type inspect global commands are supported. You cannot configure both these commands together. Skip Step 14 if you configure the parameter-map type inspect-global command. <p>Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.</p>
Step 14	<p>vrf <i>vrf-name</i> inspect <i>vrf-pmap-name</i></p> <p>Example:</p> <pre>Device(config-profile)# vrf vrf1 inspect vrf1-pmap</pre>	Binds a VRF with a parameter map.

	Command or Action	Purpose
Step 15	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 16	parameter-map type inspect <i>parameter-map-name</i> Example: Device(config)# parameter-map type inspect pmap1	Configures an inspect-type parameter map for connecting thresholds, timeouts, and other parameters pertaining to the inspect action and enters parameter-map type inspect configuration mode.
Step 17	tcp idle-time <i>seconds</i> [<i>ageout-time seconds</i>] Example: Device(config-profile)# tcp idle-time 3000 ageout-time 100	Configures the timeout for idle TCP sessions and the aggressive aging-out time for TCP sessions.
Step 18	tcp synwait-time <i>seconds</i> [<i>ageout-time seconds</i>] Example: Device(config-profile)# tcp synwait-time 30 ageout-time 10	Specifies how long the software will wait for a TCP session to reach the established state before dropping the session. <ul style="list-style-type: none"> When aggressive aging is enabled, the SYN wait timer of the oldest TCP connections are reset from the default to the configured ageout time. In this example, instead of waiting for 30 seconds for connections to timeout, the timeout of the oldest TCP connections are set to 10 seconds. Aggressive aging is disabled when the connections drop below the low watermark.
Step 19	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 20	policy-map type inspect <i>policy-map-name</i> Example: Device(config)# policy-map type inspect ddos-fw	Creates a protocol-specific inspect type policy map and enters QoS policy-map configuration mode.
Step 21	class type inspect match-any <i>class-map-name</i> Example: Device(config-pmap)# class type inspect match-any ddos-class	Specifies the traffic (class) on which an action is to be performed and enters QoS policy-map class configuration mode.
Step 22	inspect <i>parameter-map-name</i> Example: Device(config-pmap-c)# inspect pmap1	Enables stateful packet inspection for the parameter map.
Step 23	end Example: Device(config-pmap-c)# end	Exits QoS policy-map class configuration mode and enters privileged EXEC mode.

	Command or Action	Purpose
Step 24	show policy-firewall stats vrf <i>vrf-pmap-name</i> Example: Device# <code>show policy-firewall stats vrf vrf1-pmap</code>	Displays VRF-level policy firewall statistics.

Example

The following is sample output from the **show policy-firewall stats vrf vrf1-pmap** command:

```
Device# show policy-firewall stats vrf vrf1-pmap

VRF: vrf1, Parameter-Map: vrf1-pmap
Interface reference count: 2
  Total Session Count(estab + half-open): 80, Exceed: 0
  Total Session Aggressive Aging Period Off, Event Count: 0

          Half Open
Protocol Session Cnt      Exceed
-----
All          0              0
UDP          0              0
ICMP         0              0
TCP          0              0

TCP Syn Flood Half Open Count: 0, Exceed: 116
Half Open Aggressive Aging Period Off, Event Count: 0
```

Configuring the Aging Out of Firewall Sessions

You can configure the aging out of ICMP, TCP, or UDP firewall sessions.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Enter one of the following commands:
 - **parameter-map type inspect-global**
 - **parameter-map type inspect global**
4. **vrf** *vrf-name* **inspect** *vrf-pmap-name*
5. **exit**
6. **parameter-map type inspect** *parameter-map-name*
7. **tcp idle-time** *seconds* [**ageout-time** *seconds*]
8. **tcp synwait-time** *seconds* [**ageout-time** *seconds*]
9. **exit**
10. **policy-map type inspect** *policy-map-name*
11. **class type inspect match-any** *class-map-name*
12. **inspect** *parameter-map-name*
13. **end**
14. **show policy-firewall stats vrf** *vrf-pmap-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	Enter one of the following commands: <ul style="list-style-type: none"> • parameter-map type inspect-global • parameter-map type inspect global Example: Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspectglobal	Configures a global parameter map and enters parameter-map type inspect configuration mode. <ul style="list-style-type: none"> • Based on your release, the parameter-map type inspect-global and the parameter-map type inspect global commands are supported. You cannot configure both these commands together. • Skip Step 4 if you configure the parameter-map type inspect-global command. <p>Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.</p>
Step 4	vrf vrf-name inspect vrf-pmap-name Example: Device(config-profile)# vrf vrf1 inspect vrf1-pmap	Binds a VRF with a parameter map.
Step 5	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 6	parameter-map type inspect parameter-map-name Example: Device(config)# parameter-map type inspect pmap1	Configures an inspect-type parameter map for connecting thresholds, timeouts, and other parameters pertaining to the inspect action and enters parameter-map type inspect configuration mode.
Step 7	tcp idle-time seconds [ageout-time seconds] Example: Device(config-profile)# tcp idle-time 3000 ageout-time 100	Configures the timeout for idle TCP sessions and the aggressive aging-out time for TCP sessions. <ul style="list-style-type: none"> • You can also configure the tcp finwait-time command to specify how long a TCP session will be managed after the firewall detects a finish (FIN) exchange, or you can configure the tcp synwait-time command to specify how long the software will wait

	Command or Action	Purpose
		for a TCP session to reach the established state before dropping the session.
Step 8	tcp synwait-time <i>seconds</i> [ageout-time <i>seconds</i>] Example: Device(config-profile)# tcp synwait-time 30 ageout-time 10	Specifies how long the software will wait for a TCP session to reach the established state before dropping the session. <ul style="list-style-type: none"> When aggressive aging is enabled, the SYN wait timer of the oldest TCP connections are reset from the default to the configured ageout time. In this example, instead of waiting for 30 seconds for connections to timeout, the timeout of the oldest TCP connections are set to 10 seconds. Aggressive aging is enabled when the connections drop below the low watermark.
Step 9	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 10	policy-map type inspect <i>policy-map-name</i> Example: Device(config)# policy-map type inspect ddos-fw	Creates a protocol-specific inspect type policy map and enters QoS policy-map configuration mode.
Step 11	class type inspect match-any <i>class-map-name</i> Example: Device(config-pmap)# class type inspect match-any ddos-class	Specifies the traffic class on which an action is to be performed and enters QoS policy-map class configuration mode.
Step 12	inspect <i>parameter-map-name</i> Example: Device(config-pmap-c)# inspect pmap1	Enables stateful packet inspection for the parameter map.
Step 13	end Example: Device(config-pmap-c)# end	Exits QoS policy-map class configuration mode and enters privileged EXEC mode.
Step 14	show policy-firewall stats vrf <i>vrf-pmap-name</i> Example: Device# show policy-firewall stats vrf vrf1-pmap	Displays VRF-level policy firewall statistics.

Example

The following is sample output from the **show policy-firewall stats vrf vrf1-pmap** command:

```
Device# show policy-firewall stats vrf vrf1-pmap

VRF: vrf1, Parameter-Map: vrf1-pmap
Interface reference count: 2
```

```
Total Session Count(estab + half-open): 270, Exceed: 0
Total Session Aggressive Aging Period Off, Event Count: 0
```

	Half Open	
Protocol	Session Cnt	Exceed
-----	-----	-----
All	0	0
UDP	0	0
ICMP	0	0
TCP	0	0

```
TCP Syn Flood Half Open Count: 0, Exceed: 12
Half Open Aggressive Aging Period Off, Event Count: 0
```

Configuring Firewall Event Rate Monitoring

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **parameter-map type inspect-zone zone-pmap-name**
4. **alert on**
5. **threat-detection basic-threat**
6. **threat-detection rate fw-drop average-time-frame seconds average-threshold packets-per-second burst-threshold packets-per-second**
7. **threat-detection rate inspect-drop average-time-frame seconds average-threshold packets-per-second burst-threshold packets-per-second**
8. **threat-detection rate syn-attack average-time-frame seconds average-threshold packets-per-second burst-threshold packets-per-second**
9. **exit**
10. **zone security security-zone-name**
11. **protection parameter-map-name**
12. **exit**
13. **zone-pair security zone-pair-name source source-zone destination destination-zone**
14. **end**
15. **show policy-firewall stats zone**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p>parameter-map type inspect-zone <i>zone-pmap-name</i></p> <p>Example:</p> <pre>Device(config)# parameter-map type inspect-zone zone-pmap1</pre>	Configures an inspect-zone parameter map and enters parameter-map type inspect configuration mode.
Step 4	<p>alert on</p> <p>Example:</p> <pre>Device(config-profile)# alert on</pre>	<p>Enables the console display of stateful packet inspection alert messages for a zone.</p> <ul style="list-style-type: none"> You can use the log command to configure the logging of alerts either to the syslog or to the high-speed logger (HSL).
Step 5	<p>threat-detection basic-threat</p> <p>Example:</p> <pre>Device(config-profile)# threat-detection basic-threat</pre>	Configures basic threat detection for a zone.
Step 6	<p>threat-detection rate fw-drop average-time-frame <i>seconds</i> average-threshold <i>packets-per-second</i> burst-threshold <i>packets-per-second</i></p> <p>Example:</p> <pre>Device(config-profile)# threat-detection rate fw-drop average-time-frame 600 average-threshold 100 burst-threshold 100</pre>	<p>Configures the threat detection rate for firewall drop events.</p> <ul style="list-style-type: none"> You must configure the threat-detection basic-threat command before you configure the threat-detection rate command.
Step 7	<p>threat-detection rate inspect-drop average-time-frame <i>seconds</i> average-threshold <i>packets-per-second</i> burst-threshold <i>packets-per-second</i></p> <p>Example:</p> <pre>Device(config-profile)# threat-detection rate inspect-drop average-time-frame 600 average-threshold 100 burst-threshold 100</pre>	Configures the threat detection rate for firewall inspection-based drop events.
Step 8	<p>threat-detection rate syn-attack average-time-frame <i>seconds</i> average-threshold <i>packets-per-second</i> burst-threshold <i>packets-per-second</i></p> <p>Example:</p> <pre>Device(config-profile)# threat-detection rate syn-attack average-time-frame 600 average-threshold 100 burst-threshold 100</pre>	Configures the threat detection rate for TCP SYN attack events.
Step 9	<p>exit</p> <p>Example:</p> <pre>Device(config-profile)# exit</pre>	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 10	<p>zone security <i>security-zone-name</i></p> <p>Example:</p> <pre>Device(config)# zone security public</pre>	Creates a security zone and enters security zone configuration mode.

	Command or Action	Purpose
Step 11	protection <i>parameter-map-name</i> Example: Device(config-sec-zone)# protection zone-pmap1	Attaches the inspect-zone parameter map to the zone and applies the features configured in the inspect-zone parameter map to the zone.
Step 12	exit Example: Device(config-sec-zone)# exit	Exits security zone configuration mode and enters global configuration mode.
Step 13	zone-pair security <i>zone-pair-name</i> source <i>source-zone</i> destination <i>destination-zone</i> Example: Device(config)# zone-pair security private2public source private destination public	Creates a zone pair and enters security zone-pair configuration mode.
Step 14	end Example: Device(config-sec-zone-pair)# end	Exits security zone-pair configuration mode and enters privileged EXEC mode.
Step 15	show policy-firewall stats zone Example: Device# show policy-firewall stats zone	Displays policy firewall statistics at the zone level.

Configuring the per-Box Half-Opened Session Limit

Per-box refers to the entire firewall session table. Any configuration that follows the **parameter-map type inspect-global** command applies to the box.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Enter one of the following commands:
 - **parameter-map type inspect-global**
 - **parameter-map type inspect global**
4. **alert on**
5. **per-box max-incomplete** *number*
6. **session total** *number*
7. **end**
8. **show policy-firewall stats global**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: Device> enable	<ul style="list-style-type: none"> Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	Enter one of the following commands: <ul style="list-style-type: none"> parameter-map type inspect-global parameter-map type inspect global Example: Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspect global	Configures a global parameter map for connecting thresholds and timeouts and enters parameter-map type inspect configuration mode. <ul style="list-style-type: none"> Based on your release, the parameter-map type inspect-global and the parameter-map type inspect global commands are supported. You cannot configure both these commands together. Skip to Steps 5 and 6 if you configure the parameter-map type inspect-global command. Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.
Step 4	alert on Example: Device(config-profile)# alert on	Enables the console display of stateful packet inspection alert messages.
Step 5	per-box max-incomplete <i>number</i> Example: Device(config-profile)# per-box max-incomplete 12345	Configures the maximum number of half-opened connections for the firewall session table.
Step 6	session total <i>number</i> Example: Device(config-profile)# session total 34500	Configures the total session limit for the firewall session table.
Step 7	end Example: Device(config-profile)# end	Exits parameter-map type inspect configuration mode and enters privileged EXEC mode.
Step 8	show policy-firewall stats global Example: Device# show policy-firewall stats global	Displays global firewall statistics information.

Configuring the Half-Opened Session Limit for an Inspect-VRF Parameter Map

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **parameter-map type inspect-vrf** *vrf-name*
4. **alert on**
5. **max-incomplete** *number*
6. **session total** *number*
7. **exit**
8. Enter one of the following commands:
 - **parameter-map type inspect-global**
 - **parameter-map type inspect global**
9. **alert on**
10. **vrf** *vrf-name* **inspect** *vrf-pmap-name*
11. **end**
12. **show policy-firewall stats vrf** *vrf-pmap-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	parameter-map type inspect-vrf <i>vrf-name</i> Example: Device(config)# parameter-map type inspect-vrf vrf1-pmap	Configures an inspect-VRF parameter map and enters parameter-map type inspect configuration mode.
Step 4	alert on Example: Device(config-profile)# alert on	Enables the console display of stateful packet inspection alert messages.
Step 5	max-incomplete <i>number</i> Example: Device(config-profile)# max-incomplete 2000	Configures the maximum number of half-opened connections per VRF.
Step 6	session total <i>number</i> Example:	Configures the total session limit for a VRF.

	Command or Action	Purpose
	<code>Device(config-profile)# session total 34500</code>	
Step 7	<p>exit</p> <p>Example:</p> <pre>Device(config-profile)# exit</pre>	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 8	<p>Enter one of the following commands:</p> <ul style="list-style-type: none"> • parameter-map type inspect-global • parameter-map type inspect global <p>Example:</p> <pre>Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspect global</pre>	<p>Configures a global parameter map for connecting thresholds and timeouts and enters parameter-map type inspect configuration mode.</p> <ul style="list-style-type: none"> • Based on your release, you can use either the parameter-map type inspect-global command or the parameter-map type inspect global command. You cannot configure both these commands together. • Skip Step 10 if you configure the parameter-map type inspect-global command. <p>Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.</p>
Step 9	<p>alert on</p> <p>Example:</p> <pre>Device(config-profile)# alert on</pre>	Enables the console display of stateful packet inspection alert messages.
Step 10	<p>vrf vrf-name inspect vrf-pmap-name</p> <p>Example:</p> <pre>Device(config-profile)# vrf vrf1 inspect vrf1-pmap</pre>	Binds the VRF to the global parameter map.
Step 11	<p>end</p> <p>Example:</p> <pre>Device(config-profile)# end</pre>	Exits parameter-map type inspect configuration mode and enters privileged EXEC mode.
Step 12	<p>show policy-firewall stats vrf vrf-pmap-name</p> <p>Example:</p> <pre>Device# show policy-firewall stats vrf vrf1-pmap</pre>	Displays VRF-level policy firewall statistics.

Configuring the Global TCP SYN Flood Limit

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Enter one of the following commands:

- **parameter-map type inspect-global**
 - **parameter-map type inspect global**
4. **alert on**
 5. **per-box tcp syn-flood limit *number***
 6. **end**
 7. **show policy-firewall stats vrf global**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	Enter one of the following commands: <ul style="list-style-type: none"> • parameter-map type inspect-global • parameter-map type inspect global Example: Device(config)# parameter-map type inspect-global Device(config)# parameter-map type inspect global	Configures a global parameter map and enters parameter-map type inspect configuration mode. <ul style="list-style-type: none"> • Based on your release, you can configure either the parameter-map type inspect-global command or the parameter-map type inspect global command. You cannot configure both these commands together. • Skip Step 5 if you configure the parameter-map type inspect-global command. <p>Note If you configure the parameter-map type inspect-global command, per-box configurations are not supported because, by default, all per-box configurations apply to all firewall sessions.</p>
Step 4	alert on Example: Device(config-profile)# alert on	Enables the console display of stateful packet inspection alert messages.
Step 5	per-box tcp syn-flood limit <i>number</i> Example: Device(config-profile)# per-box tcp syn-flood limit 500	Limits the number of TCP half-opened sessions that trigger SYN cookie processing for new SYN packets.
Step 6	end Example: Device(config-profile)# end	Exits parameter-map type inspect configuration mode and enters privileged EXEC mode.

	Command or Action	Purpose
Step 7	show policy-firewall stats vrf global Example: Device# show policy-firewall stats vrf global	(Optional) Displays the status of the global VRF firewall policy. <ul style="list-style-type: none"> The command output also displays how many TCP half-opened sessions are present.

Example

The following is sample output from the **show policy-firewall stats vrf global** command:

```
Device# show policy-firewall stats vrf global

Global table statistics
  total_session_cnt: 0
  exceed_cnt:       0
  tcp_half_open_cnt: 0
  syn_exceed_cnt:  0
```

Configuring Firewall Resource Management



Note A global parameter map takes effect on the global routing domain and not at the router level.

SUMMARY STEPS

- enable
- configure terminal
- parameter-map type inspect-vrf *vrf-pmap-name*
- session total *number*
- tcp syn-flood limit *number*
- exit
- parameter-map type inspect-global
- vrf *vrf-name* inspect *parameter-map-name*
- exit
- parameter-map type inspect-vrf vrf-default
- session total *number*
- tcp syn-flood limit *number*
- end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example:	Enables privileged EXEC mode. <ul style="list-style-type: none"> Enter your password if prompted.

	Command or Action	Purpose
	Device> enable	
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	parameter-map type inspect-vrf vrf-pmap-name Example: Device(config)# parameter-map type inspect-vrf vrf1-pmap	Configures an inspect VRF-type parameter map and enters parameter-map type inspect configuration mode.
Step 4	session total number Example: Device(config-profile)# session total 1000	Configures the total number of sessions.
Step 5	tcp syn-flood limit number Example: Device(config-profile)# tcp syn-flood limit 2000	Limits the number of TCP half-opened sessions that trigger synchronization (SYN) cookie processing for new SYN packets.
Step 6	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 7	parameter-map type inspect-global Example: Device(config)# parameter-map type inspect-global	Configures a global parameter map and enters parameter-map type inspect configuration mode.
Step 8	vrf vrf-name inspect parameter-map-name Example: Device(config-profile)# vrf vrf1 inspect vrf1-pmap	Binds a VRF to the parameter map.
Step 9	exit Example: Device(config-profile)# exit	Exits parameter-map type inspect configuration mode and enters global configuration mode.
Step 10	parameter-map type inspect-vrf vrf-default Example: Device(config)# parameter-map type inspect-vrf vrf-default	Configures a default inspect VRF-type parameter map.
Step 11	session total number Example: Device(config-profile)# session total 6000	Configures the total number of sessions. <ul style="list-style-type: none"> You can configure the session total command for an inspect VRF-type parameter map and for a global parameter map. When you configure the session total command for an inspect VRF-type parameter map, the sessions are associated with an inspect VRF-type

	Command or Action	Purpose
		parameter map. The session total command is applied to the global routing domain when it is configured for a global parameter-map.
Step 12	tcp syn-flood limit <i>number</i> Example: Device(config-profile)# tcp syn-flood limit 7000	Limits the number of TCP half-opened sessions that trigger SYN cookie processing for new SYN packets.
Step 13	end Example: Device(config-profile)# end	Exits parameter-map type inspect configuration mode and enters privileged EXEC mode.

Configuration Examples for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management

Example: Configuring an IPv6 Firewall

```

Device# configure terminal
Device(config)# vrf-definition VRF1
Device(config-vrf)# address-family ipv6
Device(config-vrf-af)# exit-address-family
Device(config-vrf)# exit
Device(config)# parameter-map type inspect ipv6-param-map
Device(config-profile)# sessions maximum 10000
Device(config-profile)# exit
Device(config)# ipv6 unicast-routing
Device(config)# ip port-map ftp port 8090 list ipv6-acl
Device(config)# ipv6 access-list ipv6-acl
Device(config-ipv6-acl)# permit ipv6 any any
Device(config-ipv6-acl)# exit
Device(config)# class-map type inspect match-all ipv6-class
Device(config-cmap)# match access-group name ipv6-acl
Device(config-cmap)# match protocol tcp
Device(config-cmap)# exit
Device(config)# policy-map type inspect ipv6-policy
Device(config-pmap)# class type inspect ipv6-class
Device(config-pmap-c)# inspect ipv6-param-map
Device(config-pmap-c)# end

```

Example: Configuring the Aggressive Aging of Firewall Sessions

Example: Configuring per-Box Aggressive Aging

```
Device# configure terminal
Device(config)# parameter-map type inspect global
Device(config-profile)# per-box max-incomplete 2000 aggressive-aging 1500 low 1200
Device(config-profile)# per-box aggressive-aging high 1700 low 1300
Device(config-profile)# exit
Device(config)# parameter-map type inspect pmap1
Device(config-profile)# tcp synwait-time 30 ageout-time 10
Device(config-profile)# end
```

Example: Configuring Aggressive Aging for a Default VRF

```
Device# configure terminal
Device(config)# parameter-map type inspect global
Device(config-profile)# max-incomplete 2000 aggressive-aging high 1500 low 1200
Device(config-profile)# session total 1000 aggressive-aging high percent 80 low percent 60
Device(config-profile)# exit
Device(config)# parameter-map type inspect pmap1
Device(config-profile)# tcp synwait-time 30 ageout-time 10
Device(config-profile)# end
```

Example: Configuring per-VRF Aggressive Aging

```
Device# configure terminal
Device(config)# ip vrf ddos-vrf1
Device(config-vrf)# rd 100:2
Device(config-vrf)# route-target export 100:2
Device(config-vrf)# route-target import 100:2
Device(config-vrf)# exit
Device(config)# parameter-map type inspect-vrf vrf1-pmap
Device(config-profile)# max-incomplete 3455 aggressive-aging high 2345 low 2255
Device(config-profile)# session total 1000 aggressive-aging high percent 80 low percent 60
Device(config-profile)# alert on
Device(config-profile)# exit
Device(config)# parameter-map type inspect global
Device(config-profile)# vrf vrf1 inspect vrf1-pmap
Device(config-profile)# exit
Device(config)# parameter-map type inspect pmap1
Device(config-profile)# tcp idle-time 3000 ageout-time 100
Device(config-profile)# tcp synwait-time 30 ageout-time 10
Device(config-profile)# exit
Device(config)# policy-map type inspect ddos-fw
Device(config-pmap)# class type inspect match-any ddos-class
Device(config-pmap-c)# inspect pmap1
Device(config-profile)# end
```

Example: Configuring the Aging Out of Firewall Sessions

```
Device# configure terminal
Device(config-profile)# exit
Device(config)# parameter-map type inspect global
Device(config-profile)# vrf vrf1 inspect vrf1-pmap
```

```

Device(config-profile)# exit
Device(config)# parameter-map type inspect pmap1
Device(config-profile)# tcp idle-time 3000 ageout-time 100
Device(config-profile)# tcp synwait-time 30 ageout-time 10
Device(config-profile)# exit
Device(config)# policy-map type inspect ddos-fw
Device(config-profile)# class type inspect match-any ddos-class
Device(config-profile)# inspect pmap1
Device(config-profile)# end

```

Example: Configuring Firewall Event Rate Monitoring

```

Device> enable
Device# configure terminal
Device(config)# parameter-map type inspect zone zone-pmap1
Device(config-profile)# alert on
Device(config-profile)# threat-detection basic-threat
Device(config-profile)# threat-detection rate fw-drop average-time-frame 600 average-threshold
100 burst-threshold 100
Device(config-profile)# threat-detection rate inspect-drop average-time-frame 600
average-threshold 100 burst-threshold 100
Device(config-profile)# threat-detection rate syn-attack average-time-frame 600
average-threshold 100 burst-threshold 100
Device(config-profile)# exit
Device(config)# zone security public
Device(config-sec-zone)# protection zone-pmap1
Device(config-sec-zone)# exit
Device(config)# zone-pair security private2public source private destination public
Device(config-sec-zone-pair)# end

```

Example: Configuring the per-Box Half-Opened Session Limit

```

Device# configure terminal
Device(config)# parameter-map type inspect global
Device(config-profile)# alert on
Device(config-profile)# per-box max-incomplete 12345
Device(config-profile)# session total 34500
Device(config-profile)# end

```

Example: Configuring the Half-Opened Session Limit for an Inspect VRF Parameter Map

```

Device# configure terminal
Device(config)# parameter-map type inspect vrf vrf1-pmap
Device(config-profile)# alert on
Device(config-profile)# max-incomplete 3500
Device(config-profile)# session total 34500
Device(config-profile)# exit
Device(config)# parameter-map type inspect global
Device(config-profile)# alert on

```

Example: Configuring the Global TCP SYN Flood Limit

```
Device(config-profile)# vrf vrf1 inspect vrf1-pmap
Device(config-profile)# end
```

Example: Configuring the Global TCP SYN Flood Limit

```
Device# configure terminal
Device(config)# parameter-map type inspect global
Device(config-profile)# alert on
Device(config-profile)# per-box tcp syn-flood limit 500
Device(config-profile)# end
```

Example: Configuring Firewall Resource Management

```
Device# configure terminal
Device(config)# parameter-map type inspect-vrf vrf1-pmap
Device(config-profile)# session total 1000
Device(config-profile)# tcp syn-flood limit 2000
Device(config-profile)# exit
Device(config)# parameter-map type inspect-global
Device(config-profile)# vrf vrf1 inspect pmap1
Device(config-profile)# exit
Device(config)# parameter-map type inspect-vrf vrf-default
Device(config-profile)# session total 6000
Device(config-profile)# tcp syn-flood limit 7000
Device(config-profile)# end
```

Additional References for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management**Related Documents**

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Security commands	<ul style="list-style-type: none"> • Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management

Feature Name	Releases	Feature Information
IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management	Cisco IOS XE Release 3.7S	<p>IPv6 zone-based firewalls support the Protection of Distributed Denial of Service Attacks and the Firewall Resource Management features.</p> <p>The Protection Against Distributed Denial of Service Attacks feature provides protection from Denial of Service (DoS) attacks at the global level (for all firewall sessions) and at the VPN routing and forwarding (VRF) level. You can configure the aggressive aging of firewall sessions, event rate monitoring of firewall sessions, half-opened connections limit, and global TCP SYN cookie protection to prevent distributed DoS attacks.</p> <p>The Firewall Resource Management feature limits the number of VPN routing and forwarding (VRF) instances and global firewall sessions that are configured on a device.</p>
IPv6 Firewall Support for Prevention of Distributed Denial of Service Attacks and Resource Management	Cisco IOS XE Release 3.10S	In Cisco IOS XE Release 3.10S, support was added for Cisco CSR 1000V Series Routers.

